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A REVISION OF *PANICUM* SUBGENUS *PANICUM*
SECTION *RUDGEANA* (POACEAE: PANICEAE)¹

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ABSTRACT

Panicum subg. *Panicum* sect. *Rudgeana*, herein revised, includes six species: *P. cayennense*, *P. campestre*, *P. cervicatum*, *P. ligulare*, *P. rudgei* and *P. vinaceum*. It is characterized mainly by a stipitate upper anthecium. The stipe consists of two portions: a membranous portion towards the ventral face of the spikelet and an indurate portion towards its dorsal face. The position of the section within subg. *Panicum* is discussed, as is the relationship of *Rudgeana* with other sections containing species having a stipitate upper anthecium.

Hitchcock & Chase (1910) included *P. rudgei* Roemer & Schultes and *P. rotundum* A. Hitchc. & Chase within the ungrouped species of the genus and noted their close relationship. In 1915 they repeated this treatment, indicating also that the species they had described was the same as *P. campestre* Nees ex Trinius. The same year, Hitchcock also placed *P. rudgei* in an informal group he named *Rudgeana*. Chase, in unpublished manuscripts, later placed both species in the *Rudgeana* group, which she characterized as "Rather stout much branched perennials with usually harshly pilose or papillose sheaths. Spikelets abruptly pointed, the first glume pointed, more than half the length of the spikelet, the midnerve scabrous."

The two species mentioned above plus *P. cayennense* Lam., *P. ligulare* Nees ex Trin., *P. vinaceum* Sw., and *P. cervicatum* Chase share characters that allow them to be included in sect. *Rudgeana* (A. Hitchc.) Zuloaga.

Section *Rudgeana* falls within subg. *Panicum*, having the following characters in common with the rest of the sections in the subgenus [which are sects. *Panicum*, *Repentia* Stapf, *Urvilleana* (A. Hitchc. & Chase) Pilger, and *Dichotomisflora* (A. Hitchc. & Chase) Honda].

Species of subg. *Panicum* are characterized by the presence of the C₄ photosynthetic pathway of the NAD-me subtype (Brown, 1977) and are distinguished anatomically by having a double sheath around the vascular bundles. The inner

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one is a mestome sheath with thick-walled cells. It is surrounded by a Kranz outer sheath containing specialized chloroplasts that are usually disposed centripetally. Between each vascular bundle there are two or three tabular cells arranged radially. The number of secondary vascular bundles present between each primary bundle varies from two to six.

In sect. *Rudgeana*, as in most sections of subg. *Panicum*, the plants are cespitose and short rhizomatous with erect, few- to many-noded culms. The ligule is membranous at the base and short-to long-ciliate at the upper portion. The leaf blades are lanceolate to linear-lanceolate, with or without involute borders. The species are usually found in dry and open places, but some species in sect. *Dichotomisflora* and in sect. *Repentia* grow in wet places and have decumbent culms that root at the lower nodes.

The inflorescences are pyramidal, lax and diffuse, and have ellipsoid to lanceolate spikelets dispersed on the branches.

The nervation of the glumes and lemmas and ornamentation of the upper anthecium are distinctive characters that hold together the sections of the subgenus. The upper glume and lower lemma are 7- to 9-nerved (11- to 15-nerved in species of sects. *Rudgeana*, *Panicum* and *Urvilleana*), with a few exceptions in species of sects. *Dichotomisflora* and *Repentia*, in which these bracts are 5-nerved. The upper anthecium is smooth and shiny over the entire surface, and compound or both compound and simple papillae are present near the apex of the upper palea.

Panicum sect. *Rudgeana* differs from sect. *Dichotomisflora* by the length of the lower glume ($\frac{1}{4}$ to $\frac{1}{3}$ the length of the spikelet in sect. *Dichotomisflora*) and by the absence of papillae on both surfaces of the leaf epidermis; also, as noted before, species of sect. *Dichotomisflora* grow in humid places with the culms decumbent and rooting at the lower nodes. Section *Rudgeana* is separated from sect. *Repentia* by the absence of stout rootstocks at the base of the plant. Section *Urvilleana* is distinguished from sect. *Rudgeana* by having long macrohairs at the base of the upper lemma and numerous, whitish hairs covering both glumes and the lower lemma.

Section *Rudgeana* can be distinguished clearly from sect. *Panicum* and the sections mentioned above by the occurrence of a well-developed stipe at the base of the upper anthecium. Two segments of the stipe can be distinguished: a) a portion of membranous tissue towards the palea of

the upper anthecium (Figs. 1a, e, 2d, e, 3b) and b) a portion of indurate, smooth, and shiny tissue towards the lemma of the upper anthecium (Figs. 1b, f, 2a, 3c-e). The texture of the indurate portion is similar to that of the main portion of the upper anthecium. The membranous portion of the stipe is reduced in *P. cayennense* and *P. campestre* (Figs. 1e, 4g, h) or is larger and more expanded in *P. rudgei* (Fig. 3b) or remarkably noticeable in the rest of the species of the section. In *P. ligulare* and *P. vinaceum* the membranous portion of the stipe is prominent and may be prolonged into one (Fig. 5h, i) or two wings (Fig. 2e) that cover the base of the upper anthecium. In all cases the membranous portion appears turgid when the spikelet is rehydrated, and it is free from the base of the upper anthecium.

The indurate portion of the stipe is found below the upper anthecium and is appressed to the membranous portion, at least when the spikelet is immature (Figs. 1a, b, 2a, 3d, e). At maturity, it extends behind the upper anthecium as a mucro (Fig. 1f). Size and length of this mucro vary among species of the section, but it usually remains on the rachilla when the upper anthecium falls (Fig. 3c).

In Australia there exists a group of *Panicum* species with a structure similar to the stipe found in sect. *Rudgeana*. These species were transferred from *Ichnanthus* Beauv. to *Panicum* by Lazarides (1959), who noted that the appendages found at the base of the upper anthecium are not adnate to the upper lemma (as in *Ichnanthus*) but rather originate from the apex of a noticeable stipe. Shaw & Webster (1983) supported this concept, emphasizing distinctness of the appendages in *Ichnanthus* from Australian species of *Panicum*.

More recently, Lazarides & Webster (1984) removed these "ichnanthoid" species from *Panicum*, erecting for them the new genus *Yakirra*. Included in it were four species previously treated in *Panicum*: *Y. muelleri* (Hughes) Lazarides & Webster, *Y. majuscula* (F. Muell. ex Benth.) Lazarides & Webster, *Y. australiensis* (Domin) Lazarides & Webster, and *Y. pauciflora* (R. Br.) Lazarides & Webster; also included was a new species, *Y. nulla*.

They provided a table of features separating *Yakirra* from *Ichnanthus* and *Panicum* and stated that there were no conclusive characters to differentiate *Yakirra* from *Panicum* besides the presence of a stipe at the base of the upper anthecium. I regard this as correct, since the other

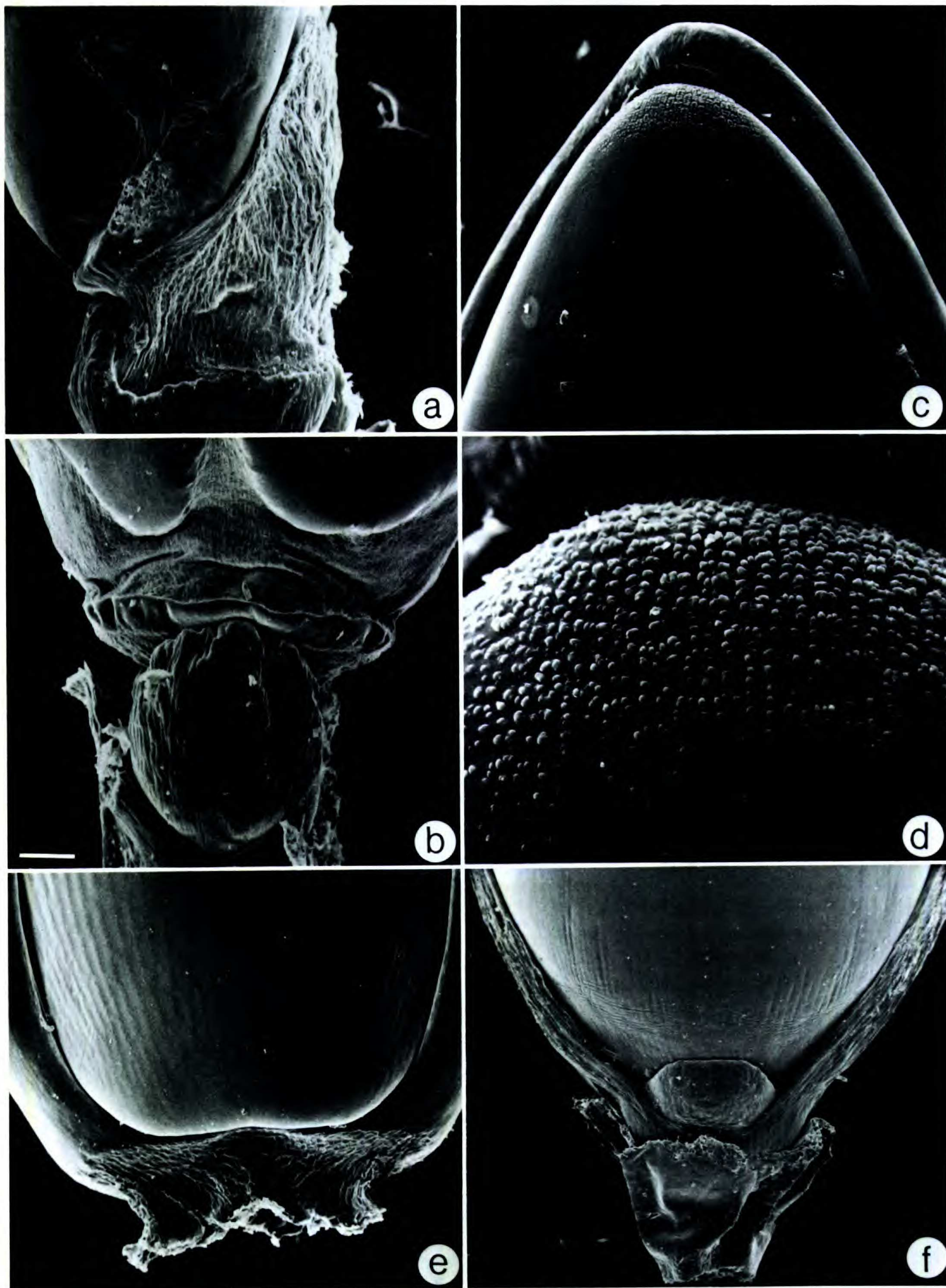


FIGURE 1. Scanning electron micrographs of the upper antheium of *Panicum* species. a–d. *P. ligulare*.—a. Lateral view of the base showing the stipe.—b. Dorsal view of the base showing the indurate portion of the stipe.—c. Apex of the upper antheium showing papillae at the tip of the palea.—d. Detail of the papillae. e, f. *P. campestre*.—e. Ventral view of the base of the upper antheium showing the membranous portion of the stipe.—f. Dorsal view showing indurate portion of stipe. a–d, based on Irwin 14904; e, f, based on Chase 8645. Scale bars: a–c, f, $\times 100$; d, $\times 500$; e, $\times 150$.

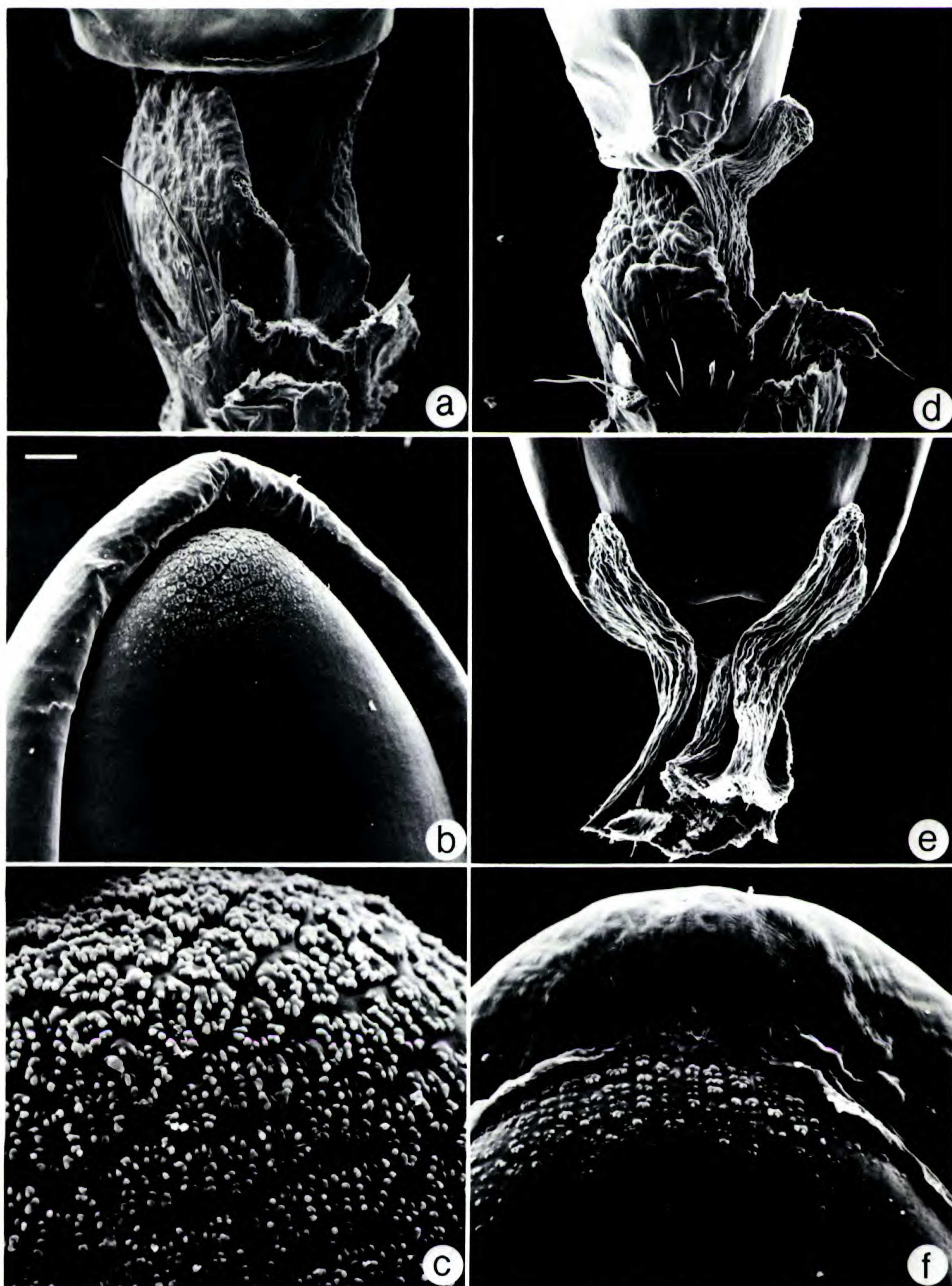


FIGURE 2. Scanning electron micrographs of the upper anthecium of *Panicum* species. a–c. *P. cervicatum*. — a. Lateral view showing the membranous and indurate portion of the stipe. — b. Apex showing compound papillae at the tip of the palea. — c. Detail of the papillae. d–f. *P. vinaceum*. — d. Lateral view of the base showing the stipe. — e. Ventral view showing the membranous appendages. — f. Apex of the upper anthecium showing compound papillae at the tip of the palea. a–c, based on Chase 10737; d–f, based on Steyermark 59173. Scale bars: a, d, $\times 50$; b, $\times 100$; c, $\times 500$; e, $\times 70$; f, $\times 300$.

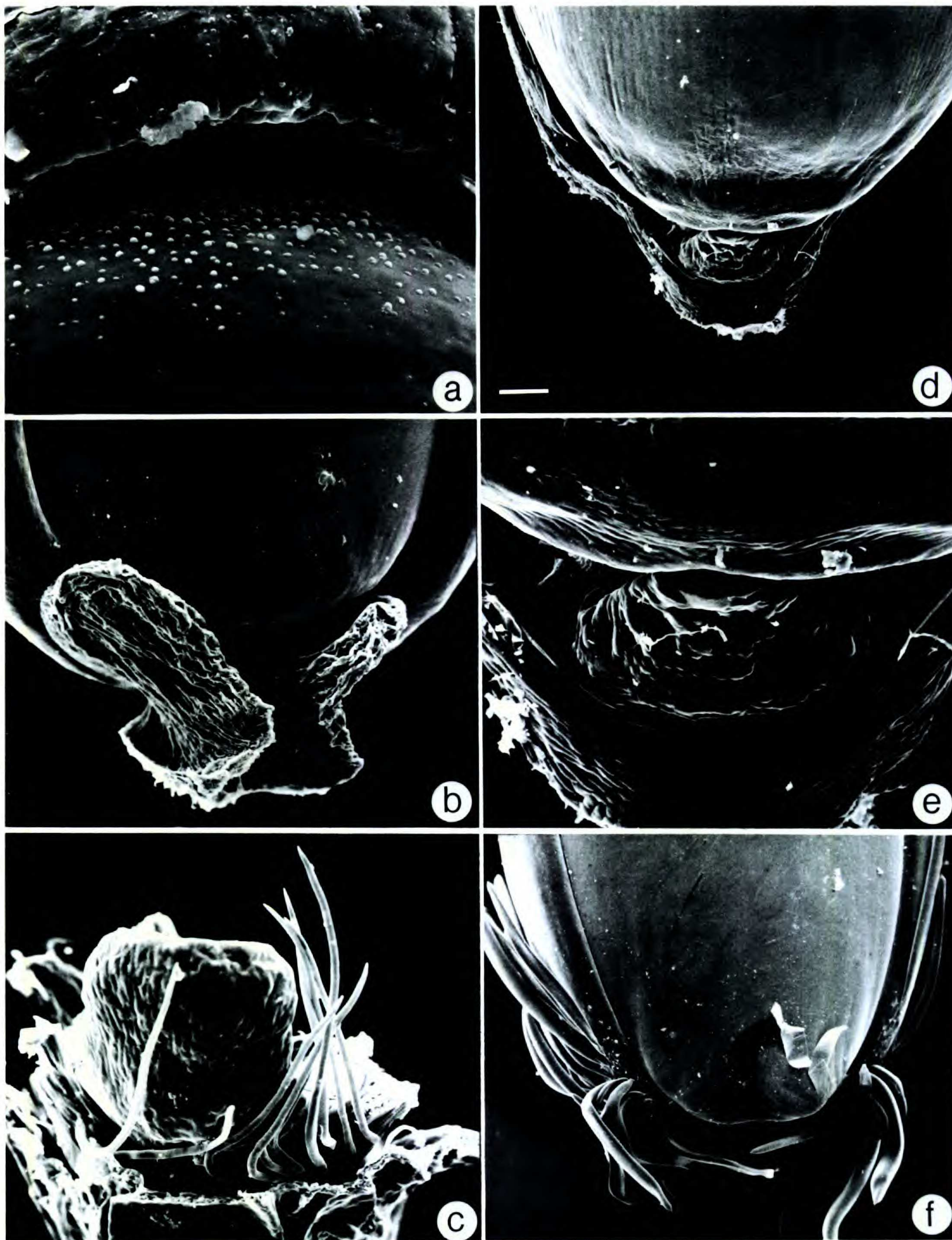


FIGURE 3. Scanning electron micrographs of the upper anthecium of *Panicum* species. a–c. *P. rudgei*.—a. Apex of the palea.—b. Ventral view of the upper anthecium showing membranous portion of stipe.—c. Indurate portion of stipe. d, e. *P. cayennense*.—d. Dorsal view of the upper anthecium showing indurate portion of stipe.—e. Indurate portion of stipe.—f. *P. olyroides*, details of hairs in the base of the upper anthecium. a–c, based on *Mexia* 5975; d, e, based on *Bommer* 54; f, based on *Chase* 10820. Scale bars: a, $\times 500$; b, $\times 130$; c, $\times 150$; d, f, $\times 100$; e, $\times 300$.

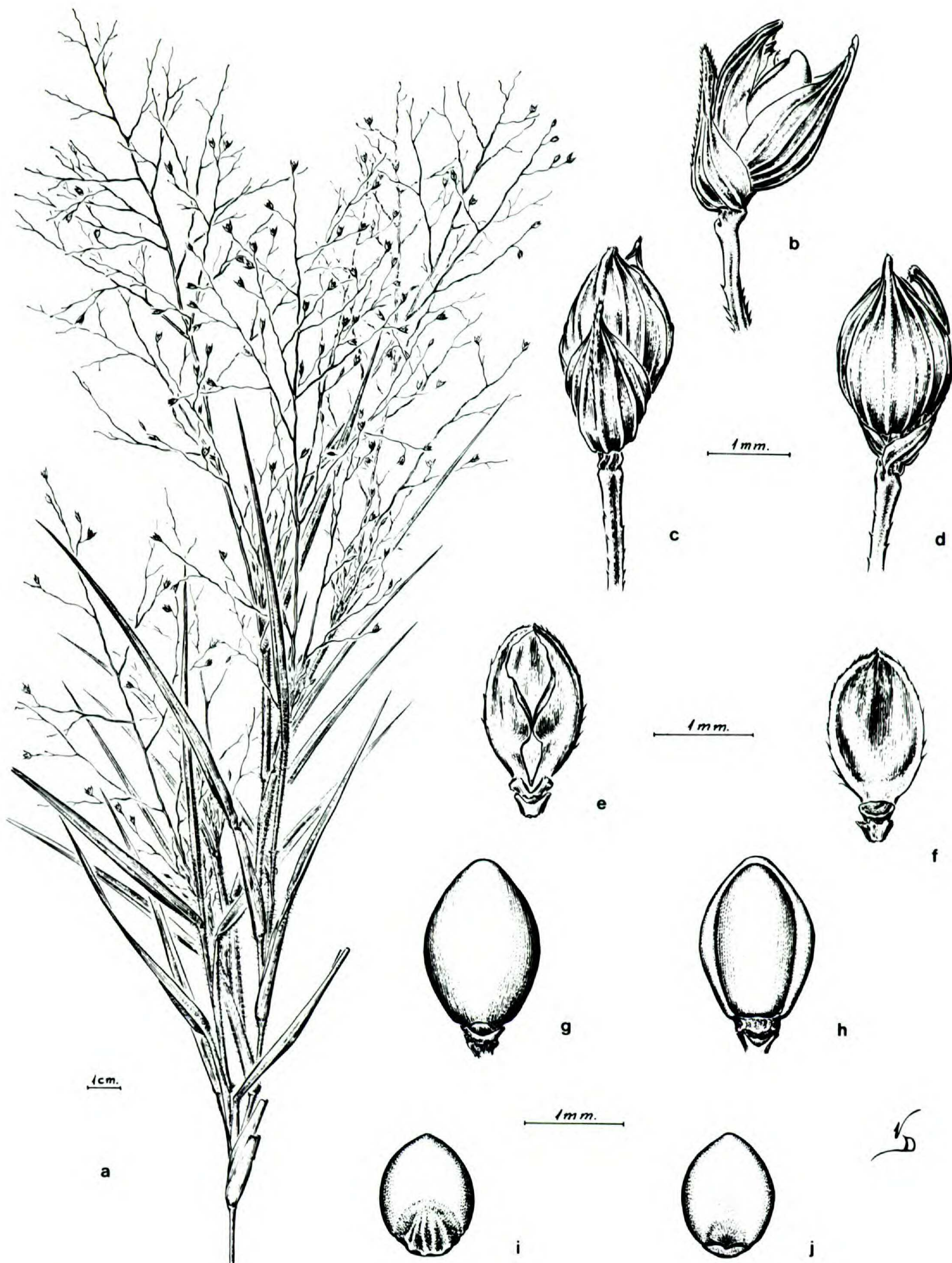


FIGURE 4. *Panicum campestre*. —a. Habit. —b. Spikelet, lateral view. —c. Spikelet, ventral view. —d. Spikelet, dorsal view. —e. Lower palea, dorsal view. —f. Lower palea, ventral view. —g. Upper antheridium, dorsal view. —h. Upper antheridium, ventral view. —i. Caryopsis, embryo side. —j. Caryopsis, hilum side. Based on Sendulsky 637.

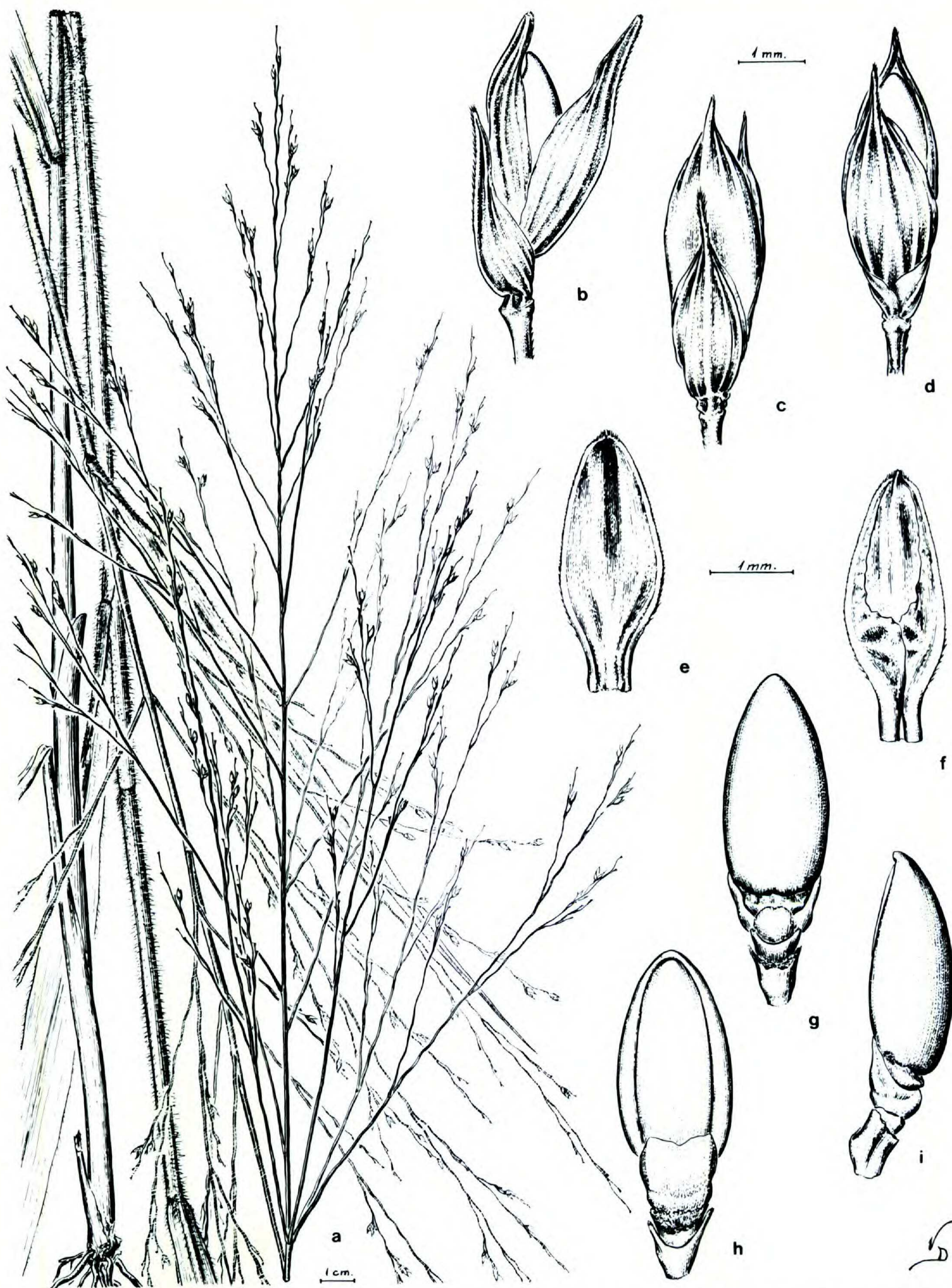


FIGURE 5. *Panicum ligulare*.—a. Habit.—b. Spikelet, lateral view.—c. Spikelet, ventral view.—d. Spikelet, dorsal view.—e. Lower palea, ventral view.—f. Lower palea, dorsal view.—g. Upper antheridium, dorsal view.—h. Upper antheridium, ventral view.—i. Upper antheridium, lateral view. Based on Irwin 14904.

TABLE 1. Comparison of sections of *Panicum* with stipitate upper anthercia.

Characters	Subg. <i>Phanopyrum</i>		
	Sect. <i>Stolonifera</i>	Sect. <i>Parvifolia</i>	Sect. <i>Phanopyrum</i>
Stipe morphology	Homogeneous	Homogeneous	Homogeneous
Stipe presence	In all species	In a few species	In the only species
Photosynthetic pathway	C ₃	C ₃	C ₃
Compound papillae at tip of palea	Absent	Absent	Absent
Inflorescence type	Racemose branches	Paniculate branches	Racemose branches
Upper glume and lower lemma nerivation	3- to 5-nerved	3- to 5-nerved	3- to 5-nerved
Panicle dimorphism	Absent	Absent	Absent

characters listed for *Yakirra* (habit, life form, spikelet compression, type of glumes and lower lemma, lower floret, and photosynthetic pathway) are common features of different sections of subg. *Panicum*.

Lazarides & Webster (1984) noted the presence of a stipitate flower in the American *P. gymnocarpon* Ell. On this basis they accepted this species as correctly placed by some authors in the monotypic genus *Phanopyrum* (Raf.) Nash and asserted that “The acceptance of *Phanopyrum* as a valid genus makes *Yakirra* morphologically distinct from *Panicum*, based on the presence or absence of a stipitate flower.”

However, stipitate upper florets are also present in species of sects. *Lorea* Zuloaga, *Agrostoida* (A. Hitchc. & Chase) Hsu, *Stolonifera* (A. Hitchc. & Chase) Pilger, *Dichanthelium*, and *Parvifolia* (A. Hitchc. & Chase) Pilger. Characters distinguishing these taxa are summarized in Table 1.

Section *Rudgeana* is similar to *Yakirra* in details of habit, leaf blades, ligules, inflorescences, spikelet compression and length, form and nervation of glumes and lower lemma. It differs from the Australian genus mainly by having a heterogeneous stipe below the upper anthercium, a lower palea (almost absent in *Yakirra*) well-developed, and the upper anthercium with compound papillae at the tip of the palea only. In species of *Yakirra* the anthercium has simple papillae in longitudinal rows all over the lemma and palea.

Therefore, the presence of a heterogeneous stipe in sect. *Rudgeana* is a good character for its delimitation within subg. *Panicum*, but I judge it

to be an insufficient one for removing species from *Panicum*.

The elongation of the rachilla could help in opening the spikelet and posterior dispersal of the caryopsis. Davidse (in press) has pointed out that the stipe below the upper anthercium in *P. cervicatum* is an elaiosome involved in ant dispersal of the diaspore and noted that a similar elaiosome might be present in *P. vinaceum* and *P. trinii*. Berg (1985) reported a similar elaiosome in the stipe of *Panicum australiense* Domin.

METHODS AND MATERIALS

Classical taxonomic studies have been carried out in this paper, utilizing a Wild M5 dissecting microscope and a Wild M20 microscope. For higher magnification, specimens were viewed in a Cambridge S4-10 or Cambridge Stereoscan 250 Mk 2 scanning electron microscope operating at 10–20 kV. Specimens from the following herbaria were examined: B, BAA, CEPEC, F, GH, LE, M, MO, NY, P, R, RB, S, SI, SP, and US.

SYSTEMATIC TREATMENT

Panicum* subg. *Panicum* sect. *Rudgeana (Hitchcock) Zuloaga, stat. nov. Group *Rudgeana* A. Hitchc., North American Flora 17(3): 201. 1915. TYPE: *Panicum rudgei* Roemer & Schultes.

Cespitose perennials or occasionally annuals, with erect, more or less branched culms and usually pilose leaves. *Ligule* membranous, short- to long-ciliate. *Leaf blades* lanceolate to linear-lan-

TABLE 1. Continued.

Subg. <i>Phanopyrum</i>	Subg. <i>Dichanthelium</i>	Subg. <i>Agrostoides</i>	Subg. <i>Panicum</i>	Genus <i>Yakirra</i>
<i>Lorea</i>	<i>Dichanthelium</i>	<i>Agrostoides</i>	<i>Rudgeana</i>	
Homogeneous	Homogeneous	Homogeneous	Heterogeneous	Homogeneous
In a few species	In a few species	In a few species	In all species	In all species
C ₃	C ₃	C ₄ NADP-me	C ₄ NAD-me	C ₄ NAD-me
Absent	Absent	Absent	Present	Present
Paniculate	Paniculate	Paniculate	Paniculate	Paniculate branches
branches	branches	branches	branches	
3- to 5-nerved	7- to 9-nerved	3- to 5-nerved	7- to 11-nerved	7- to 9-nerved
Absent	Present	Absent	Absent	Absent

ceolate, flat. *Inflorescence* a single, terminal and lax panicle or a terminal and several axillary panicles forming an elongated, compound arrangement; pedicels long, flexuous. *Spikelets* obovoid to ellipsoid, falling from the pedicels, pilose with long, rigid hairs to glabrous, pale to nearly purplish; glumes and lower lemma with 5–9(–11) prominent nerves, gaping and exposing the fertile floret at maturity. *Glumes* unequal, the lower glume ½ to ¾ as long as the spikelet; upper glume and lower lemma a little longer than the antherium, pointed at the apex. *Lower palea* conspicuous, membranous, with or without a male flower. *Upper antherium* stipitate, ovoid, glabrous, smooth and shiny, indurate; stipe membranous ventrally, indurate dorsally; *palea* with compound papillae at the apex (papillae occasionally absent in *P. cayennense*). *Stamens* 3; *stigmas* 2, plumose and purple; *lodicules* 2, membranous, glabrous. *Caryopsis* with the hilum punctiform. Embryo less than half the length of the caryopsis.

Species of sect. *Rudgeana* grow in open and sunny places, and are common in savannas of Central and South America and in the cerrado of Brazil; they are frequently found in sandy soils from sea level to ca. 1,500 m.

- KEY TO THE SPECIES OF SECTION *RUDGEANA*
- 1a. Panicles terminal, lax; axillary panicles usually absent; spikelets 4.4–9 mm long, 1.2–2.5 mm wide; stipe prominent, 1 mm or longer.

2a. Stipe glabrous basally; leaf sheaths papillose-pilose, with glassy hairs; ligule 1.8–3.2 mm long; spikelets 4.4–5.7 mm long 4. *P. ligulare*

2b. Stipe pilose basally; leaf sheaths glabrous

- to pilose, but without glassy hairs; ligule 0.6–2 mm long; spikelets 5.9–9 mm long.
- 3a. Spikelets 7–9 mm long, 2.1–2.5 mm wide; upper antherium 4–4.5 mm long 3. *P. cervicatum*

3b. Spikelets 5.9–6.7 mm long, 1.5–2 mm wide; upper antherium 3–3.5 mm long 6. *P. vinaceum*
- 1b. Panicles terminal and axillary, forming an oblong compound inflorescence; spikelets 2.1–3.5 mm long, 1–1.3 mm wide; stipe 0.5 mm or shorter.

4a. Spikelets 3–3.5 mm long; leaf sheaths usually with glassy hairs 5. *P. rudgei*

4b. Spikelets 2.1–2.8 mm long; leaf sheaths without glassy hairs.

5a. Plants perennial; spikelets ovoid, sparsely pilose, 2.6–2.8 mm long 1. *P. campestre*

5b. Plants annual; spikelets obovoid, glabrous, 2.1–2.6 mm long 2. *P. cayennense*

1. ***Panicum campestre*** Nees ex Trin., Gram. Pan. 197. 1826. TYPE: “V. sp. Brasil (N. ab Esenb.).” Not seen.
- P. rotundum* A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 15: 139. 1910. TYPE: Brazil. Minas Gerais: 1845, *Widgren s.n.* (holotype, US; fragment of holotype, BAA).

Perennial, 30–74 cm tall, usually with thick adventitious roots. *Culms* erect or geniculate at the base, rooting or not at the lower nodes, many-branched; internodes cylindrical or compressed, 3–10 cm long, hirsute with appressed, rigid hairs to glabrescent; nodes densely pilose, with long and whitish hairs. *Leaf sheaths* 3–7 cm long, usually shorter than the internodes, the lower ones longer, hirsute with long, tuberculate hairs; mar-

gins ciliate. *Ligule* 1.5–2.5 mm long, with hairs on the back towards the base of the blade; collar pilose, stramineous to brownish. *Leaf blades* linear-lanceolate, 7–25 cm long, 0.5–0.7 cm wide, flat or with involute borders, acuminate apically, rounded or subcordate basally, densely hirsute on both surfaces, with scabrous and ciliate margins, the midnerve manifest. *Panicles* terminal and axillary, forming an oblong, compound inflorescence, sometimes the terminal panicle distant from the other ones, lax and diffuse; *axis* sparsely hirsute, at least in the lower portion, longitudinally ridged, flexuous, scabrous, the branches alternate, divaricate, flexuous and scabrous, the axils of the branches pilose; pedicels long, scabrous. *Spikelets* ovoid, 2.6–2.8 mm long, 1–1.2 mm wide, sparsely pilose, pale to purple toward the apex to completely purplish. *Lower glume* 1.8–2.2 mm long, $\frac{1}{2}$ – $\frac{3}{4}$ as long as the spikelet, acuminate to subulate, with rigid hairs toward the apex, 5–9-nerved, the midnerve scabrous. *Upper glume* and *lower lemma* subequal, acuminate, 2.6–2.7 mm long, 7–9-nerved, sparsely pilose on the inner surface and with or without long and sparse hairs on the outer surface. *Lower palea* elliptic, 1.8–2 mm long, present or absent. *Upper antheridium* broadly ellipsoid, 1.8–2 mm long, 1 mm wide, pale; lemma 7-nerved; palea with compound papillae at the apex; stipe with the membranous and indurate portion ca. 0.2 mm long. *Caryopsis* 1.2–1.3 mm long, 1 mm wide. In flower December–May. Figure 4.

Distribution. Brazil, from Pará and Bahia to Paraná; 0–1,500 m; growing in sandy or red clay soils in campos or cerrados.

Selected specimens examined. BRAZIL. BAHIA: Serra Geral de Caitité, 9.5 km S of Caitité on road to Brejinhos da Ametistas, *Harley* 21319 (CEPEC). DISTRITO FEDERAL: Universidad de Brasília, *Clayton* 4795 (NY, US), 4842 (MO, NY, US); E of Lagoa Paranoa, *Irwin et al.* 11181 (F, GH, NY, US); 15 km S of Brasília, *Irwin & Soderstrom* 5700 (US); Sobradinho, *Clayton* 4875 (NY). GOIAS: 6–7 km E of Alto Paraíso, *Anderson* 6515 (MO, NY); 26 km NE of Catalão, *Irwin et al.* 25210 (F, MO, NY, US); 75 km N of Corumbá de Goiás, *Irwin et al.* 19000 (F, GH, MO, NY, US); 14 km S of Niquelandia, *Irwin et al.* 34386, 34387 (F, NY, US); 16 km N of São João da Aliança, *Dawson* 14442 (US); between Viannópolis and Ponta Funda, *Chase* 11315 (US); Serra do Rio Preto, 14 km E of Cabeceiras, *Irwin et al.* 10354 (US); Corumbá, *Macedo* 4482 (BAA, US). MATO GROSSO: 1 km NE of Garapé, 1 Oct. 1964, *Irwin & Soderstrom* s.n. (US-2642542). MATO GROSSO DO SUL: Campo Grande, *Chase* 10790 (GH, RB, US), *Swallen* 9598 (US). MINAS GERAIS: Bar-

bacena, Serra Mantiqueira, *Chase* 8645 (F, GH, NY, RB, US); Corinto, Fazenda Diamante, *Mexia* 5567 (F, GH, NY, R, US); 11 km N of Gouveia, *Anderson et al.* 35584 (MO, NY); Faria, Serra da Bocaina, *Chase* 10533 (F, NY); 10 km W of Barão de Coçais, *Irwin et al.* 28827 (F, MO, NY, US); 7 km W of Campanha, *Davidse et al.* 10651 (MO, NY); 33 km NE of Francisco Sá, *Irwin et al.* 23071 (F, MO, NY, SP); 35 km SW of Gouveia, *Anderson et al.* 35148 (F, MO, NY); 9 km NE of Estiva, *Davidse et al.* 10544 (MO); Ouro Preto, *Chase* 9354 (F, NY, US); 2 km S of Itacolumy, *Irwin et al.* 29364 (F, MO); Poços de Caldas, *Chase* 10637 (US); Piloos, *Macedo* 4876 (NY, US); lower slopes of Serra da Piedade, *Irwin et al.* 28730 (NY); between Sucupira and Omega, *Chase* 11198 (US); Oliveira, *Chase* 8856 (US); Lavras, *Chase* 8815 (US), *Maia* 18 (RB); Jardim, *Widgren* 908 (US); Lagoa Santa, *Chase* 8995 (US); Hermilo Alves, *Duarte* 6352 (US). PARA: Marajó ate Natal, *Schwacke* 62 (R); Fazenda Conceição, Rio Aurá, *Black* 54-16109 (R). PARANA: Jaguarahyva, *Dusén* 16393 (F, GH, NY, US), 10074 (US), *Swallen* 8678 (US); 2 km W of Rio Itararé and road PR-11, *Davidse et al.* 11375 (MO, NY). RIO DE JANEIRO: Monte Serrat, Serra da Itatiaia, *Chase* 8358 (F, GH, MO, NY, US); Resende, *Hoehne & Gert* 17583 (GH, US). SAO PAULO: 8 km N of Avare, *Clayton* 4526 (BAA, GH, NY, SP, US); Campinas, *Novaes* 1269 (US); Ytú, *Russell* 186 (US); Mandaquí, *Usteri* 9820 (SP, US); 10 km S de São Paulo, Parque do Estado, *Sendulsky* 208, 311 (SP, US), 637, 716, 725 (SP), *Fonseca* 13 (MO, NY, SP, US); 3 km from Cajuru, *Sendulsky* 126 (SP, US); 16 km NNE of Padua Sales, *Eiten* 1669 (NY).

Although it was not possible to examine the type specimen of this species, *P. campestre* is clearly differentiated by the diagnosis given by Trinius and by the illustration of this same author (1829).

Nees (1829) published another species with the same name, the type specimen being completely different from the species described by Trinius. *Panicum campestre* Nees of 1829 was validly renamed as *P. peladoense* by Henrard (1940).

2. ***Panicum cayennense*** Lamarck, Tabl. Encycl. 1: 173. 1791. TYPE: "Cayenne, *D. Stoupy*" (holotype, P, not seen; fragment of holotype, BAA, US-81397).

P. sessilicaule Desv., Opusc. 95. 1831. TYPE: "Habitat in Carolina" (holotype, P; fragment of the holotype, BAA).

P. floribundum Rich. ex Lam., Encycl. 4: 742. 1798, pro syn. *P. cayennense*.

P. pedunculare Willd. ex Steudel, Syn. Pl. Glum. 1: 77. 1854. TYPE: "*P. cayennense* Nees. Agr. Bras. 195. Brasil" (fragment of the syntype: "America meridionale, from Humboldt," US-2907507).

P. cayennense var. *curtatum* Doell, in C. Martius, Fl. Bras. 2(2): 220. 1877. TYPE: "extra fines in via inter Cayenne et Baduel (Yelski, inter plantas a cl. Rostafinski benigne mecum communicatas)" (fragment, US-80517).

Annual, to 110 cm tall. *Culms* erect or spreading, usually branching at the lower and middle nodes, often zigzag, few-noded; internodes hollow, compressed, hispid to glabrous; nodes dark, covered with whitish hairs. *Leaf sheaths* 2–8 cm long, shorter or longer than the internodes, pilose, with thick, tuberculate hairs; margins ciliate. *Ligule* 0.8–1.6 mm long; collar pilose, pale. *Leaf blades* linear-lanceolate, 5–28 cm long, 0.4–1 cm wide, flat, acuminate apically, rounded at the narrowed base, hispid on both surfaces to glabrescent, the margins scabrous and ciliate, the midnerve manifest. *Panicles* several, terminal and from the upper leaf axils, forming an elongated compound inflorescence 5–32 cm long, 3–12 cm wide, reaching $\frac{2}{3}$ to almost the entire height of the plant, each panicle included at the base; *axis* longitudinally ridged, flexuous, scabrous and hispid towards the base, the branches divaricate, alternate to opposite, sometimes pseudovercillate, scabrous and flexuous, the axils of the branches pilose to glabrous; pedicels long, flexuous and scabrous. *Spikelets* obovoid, 2.1–2.6 mm long, 1.1–1.3 mm wide, glabrous, globose, pale to purplish. *Lower glume* 1.2–1.8 mm long, more than half the length of the spikelet, acuminate apically, pilose on the inner surface, 5-nerved, the midnerve scabrous toward the apex. *Upper glume* 2.2–2.5 mm long, acute apically, 7-nerved, pilose to glabrous on the inner surface. *Lower lemma* 2–2.4 mm long, 7-nerved. *Lower palea* elliptic, 1.6–1.9 mm long, 0.6–1.1 mm wide, membranous, glabrous; male flower absent. *Upper antheridium* broadly ovoid, 1.5–1.8 mm long, 0.9–1.2 mm wide, pale; stipe less than 0.3 mm long, the indurate portion prolonged beyond the upper antheridium as a mucro. *Caryopsis* broadly ovoid, 0.9 mm long, 0.7 mm wide, pale. In flower all year.

Distribution. Mesoamerica, West Indies (Cuba, Jamaica and Dominican Republic), and South America, from Venezuela to Bolivia; 0–1,500 m; occurring in savannas, in sandy or clay soils.

Chromosome number. $n = 27$ (Davidse & Pohl, 1974).

Selected specimens examined. MEXICO. CHIAPAS: Escuintla, *Matuda* 1799 (F, NY, US). OAXACA: Tuxtepec, *Martínez* 1676 (MO, NY); Santiago de Jocotepec, *Vera Santos* 3372 (MO, US). TABASCO: 21 km W of Cárdenas, *Conrad & Conrad* 2959 (MO). VERACRUZ: Vicinity of Río Tonto, 6 km W of Campo Experimental de Hule, *Vera Santos* 2275 (NY, US). GUATEMALA. IZABAL: S of Río Dulce, at Shell Station, *LeDoux et al.*

106 (NY). PETEN: Santa Rita, 20 km al S de Santa Elena, *Molina* 15533 (US). BELIZE. EL CAYO: Mountain Pine Ridge, San Agustín, *Lundell* 6585 (F, NY, US). HONDURAS. ATLANTIDA: Vicinity of Tela, *Standley* 54701 (US). COSTA RICA. PUNTARENAS: 0.5 km S of Buenos Aires, *Pohl & Davidse* 10761 (F); between San Antonio and Boruca, *Pohl & Davidse* 10979 (F). SAN JOSE: Buenos Aires, *Tonduz* 3685 (US), *Valerio* 1062 (F). ALAJUELA: Grecia, Hacienda La Argentina, *Valerio* 601 (F, US), 605 (F). PANAMA. CHIRIQUI: 5 miles S of Boquete, *McDaniel* 6807 (MO); vicinity of David, *Hitchcock* 8372 (F, MO, NY, US). PANAMA: Near Arraiján, *Woodson, Jr.* 1402 (MO, NY, US). CUBA. ISLA DE PINOS: Near Nueva Gerona, *Curtiss* 267 (MO, US); vicinity of San Pedro, *Britton et al.* 14455 (MO, US); Isla de Pinos, *Taylor* 34 (MO, US). ORIENTE: Cayo del Rey, *Ekman* 10028 (US). PINAR DEL RIO: Herradura, *Tracy* 9073 (US), 9093 (MO), *Britton et al.* 6520 (US); Sierra de Cabra on Guane road, *Britton et al.* 7275 (US); Laguna Jovero and vicinity, *Shafer* 10510 (US). JAMAICA. Halliss Savanna, Upper Clarendon, *Harris* 12226 (MO). DOMINICAN REPUBLIC. DISTRITO NACIONAL: Sierra Prieta, Villa Mella, *Liogier* 17408 (US). LA VEGA: Vicinity of Pedra Blanca, *Allard* 16060, 16067 (US); Cordillera Central, Sabana de la Mar, El Valle, *Ekman* 15694 (US). MONTE CRISTI: Lagunas de Canobi, *Valeur* 7 (US). COLOMBIA. CAUCA: Buenos Aires, *Lehmann* 5268, 5269 (US). CORDOBA: Ayapel, Hacienda Simba, *Fernández* 11 (MO). Without department and locality, *Mutis* 5359, 5378, 5498, 6110 (US). VENEZUELA. AMAZONAS: Puerto Ayacucho, *Williams* 13085 (F, US); near Capuana, *Davidse & Huber* 16811 (MO); 23 km NE of Puerto Ayacucho, *Davidse & Huber* 15340 (MO). ANZOATEGUI: Pariaguán, 1 Oct. 1939, *Muller s.n.* (US). GUARICO: 28 km N of Santa Rita, *Davidse* 4319 (MO). MONAGAS: 3 km E of Jusepín, *Davidse et al.* 4548 (MO). FRENCH GUIANA. Cayenne, *Leprieux s.n.* (MO-1640162, US-2305642), 54 (R); route de Rachombeau, *Hooek s.n.* (NY). SURINAME. In distr. Pará, *Kappler* 1495 (MO). BOLIVIA. SANTA CRUZ: Buena Vista, *Steinbach* 6935 (BAA, F, GH, LIL, MO, NY, US). BRAZIL. AMAPA: Rio Pedreira, *Frões & Black* 17322 (US); Macapá, Fazendainha, *Black & Lobato* 50-9659 (US). AMAZONAS: 2 km S of Labrea, *Prance et al.* 8177 (F, GH, MO, NY); km 27 of road Humaitá-Porto Velho, *Prance et al.* 3517 (MO). BAHIA: Col. Valença, *Pinto* 1021 (US). GOIAS: 2 km SW of Araguiana, *Eiten* 10154 (US). MATO GROSSO: 20 km S of Garapú, *Irwin & Soderstrom* 6485 (US). MATO GROSSO DO SUL: 100 km W of Coxim, *Bommer* 54 (NY, US); Paiaguás, Fazenda Alvorada, *Allem & Vieira* 1001 (MO); Xavantina-Cachimbo road, W of km 229, *Philcox et al.* 3631 (NY, RB). MARANHÃO: Barra do Corda to Grajahú, *Swallen* 3674 (RB, SP, US). PARA: Ilha de Marajó, Fazenda Gavinho, *Goeldi* 245 (F, US); Oriximina, Cachoeira Porteira, *Davidson et al.* 10692 (MO); Belém, *Archer* 7587 (US); Cuminá, *Kuhlmann* 1701 (US). RONDONIA: 2–4 km E of Abuna, *Prance et al.* 8600 (MO, NY, R); 2–4 km E of Mutumparaná, *Prance et al.* 8831 (F, MO).

Panicum cayennense differs from *P. campestre* mainly by its smaller, glabrous, and obovoid spikelets. It also differs in its annual habit; in *P. cayennense* the culms are generally short, branched, and bear numerous panicles nearly

from the base, the axillary ones aggregating with the apical ones. Nevertheless, there are some specimens with elongated culms in which the terminal panicles are somewhat separated from the axillary ones.

This species was included by A. Hitchcock & Chase (1915) in the *Capillaria* group, along with *P. miliaceum*, *P. capillare*, and others, but the presence of the characteristic stipe of sect. *Rudgeana* clearly separates it from these species.

3. ***Panicum cervicatum*** Chase, J. Wash. Acad. Sci. 32: 164, f. 10, 1942. TYPE: Brazil. Mato Grosso do Sul: Tres Lagoas, 4 Feb. 1930, A. Chase 10737 (holotype, US-1500814; isotypes, RB, US-1816795).

Perennial, 40–100 cm tall. *Culms* erect, simple or occasionally branched; internodes 7–23 cm long, terete, glabrous to sparsely pubescent just below the nodes; nodes densely pilose to glabrous. *Leaf sheaths* 7–13 cm long, the lower ones overlapping, pale, densely hirsute to glabrous; margins ciliate. *Ligule* 1.5–2 mm long; collar dark brown, short- to long-pilose. *Leaf blades* lanceolate, stiff, 16–36 cm long, 0.8–1.6 cm wide, long-acuminate apically, subcordate basally, flat or the margins involute in drying, hispid or strigose to glabrous on both surfaces, the margins scabrous and largely ciliate with papillose-pilose hairs (these hairs caducous), the midnerve prominent. *Panicles* lax, diffuse, many-flowered, 25–60 cm long, 12–35 cm wide, the spikelets in pairs; *axis* longitudinally ridged and scabrous, the branches alternate or opposite, scabrous, the axils of the branches pilose and pale; axillary panicles usually absent, when present similar in shape and smaller than the terminal one; pedicels scabrous, 2–20 mm long, the spikelets set obliquely on the pedicels. *Spikelets* ellipsoid, 7–9 mm long, 2.1–2.5 mm wide, glabrous, pale to purplish. *Lower glume* 3.5–3.8 mm long, acuminate, 7–11-nerved, the midnerve scabrous towards the apex. *Upper glume* 6.7–8.4 mm long, sparsely pilose to glabrous, long pilose at the base, the inner surface pilose towards the apex, 7–11-nerved, the midnerve scabrous. *Lower lemma* glumiform, 6.2–7.3 mm long, long pilose at the base, the inner surface pilose, purplish, 7–9-nerved. *Lower palea* elliptic to obovate, 4–5.8 mm long, 1.3–2.2 mm wide, membranous, the borders pilose; male flower absent. *Upper antheridium* ovoid to ellipsoid, 4–4.5 mm long, 1.8–2.1 mm wide, at maturity 2.5 mm wide and dark brown; stipe ca. 1

mm long, somewhat fleshy with an expanded summit and a thick, indurate process on the back, prolonged beyond the base of upper antheridium at maturity; rachilla pilose below the stipe. *Caryopsis* 2.8–3.2 mm long, 1.5–2.2 mm wide. In flower December–September.

Distribution. Bolivia and Brazil; sandy or sandy-clay savannas, campos or open cerrados; 400–1,300 m.

Additional specimens examined. BOLIVIA. SANTA CRUZ: Santiago de Chiquitos, San Micerato, *Cárdenas* 4506 (US); Chiquitos, cerca de El Carmen, *Cárdenas* 4503 (US). BRAZIL. BAHIA: Road to Posse, 225 km SW of Barreiras, *Irwin et al.* 14657 (MO, NY, SP, US); Espigão Mestre, 100 km WSW of Barreiras, *Anderson et al.* 36654 (F, MO, NY, US); Rio Roda Velha and highway BR-020, *Davidse et al.* 12084 (MO, NY). DISTRITO FEDERAL: Universidade de Brasília, *Clayton* 4809 (SP), 4839 (NY, SP); 20 km E of Brasília, *Irwin et al.* 9213 (F, MO, NY, US); Brasília, *Belém* 1970 (CEPEC); 15 km E of Brasília, *Irwin & Soderstrom* 5711 (F, MO, NY, US); 1 km W of Sobradinho, *Irwin et al.* 11077 (MO, NY, US); Brasília, entre UNB y Parque Flor, *Pires et al.* 9176 (F, SP, US). GOIAS: 1 km W of Veadeiros, *Irwin et al.* 12754 (F, MO, NY, US); 3 km N of Cristalina, *Irwin et al.* 13268 (F, MO, NY, US); 16 km SW of Goiás-Bahia border, *Davidse et al.* 12193 (NY); between Jatahy and Rio Araguaia, *Chase* 11736 (US); vicinity of Anápolis, *Chase* 11519 (US); 38 km N of São Jose da Aliança, *Dawson* 14354 (US); 40 km W of Rio Verde, *Chase* 11713 (US); W of Santa Rita do Araguaia, *Chase* 11863 (US); between Vianópolis and Ponta Funda, *Chase* 11281 (US). MATO GROSSO: Rodovia Cuiabá-Santarem, *Lemes* 4125 (RB); Rondonópolis, Rio Paguba, *Rondon* 2566 (RB, US); Diamantina, *Weddell* 3081 (US). MATO GROSSO DO SUL: Xavantina-Cachimbo road, 85 km from Xavantina, *Hunt & Ferreira* 5739 (NY, SP, US); NW of São Lourenço, *Chase* 11959 (US). MINAS GERAIS: Lagoa Santa, 14 Feb. 1864, *Warming s.n.* (US); 26 km NE of Patrocínio, *Irwin et al.* 25582 (F, NY, SP); Serra do Cipó, 110 km NE of Belo Horizonte, *Chase* 9138 (F, GH, MO, NY, US); between Sucupira and Omega, S of Uberlândia, *Chase* 11167 (US); 3–4 km de Prata, *Sendulsky* 18 (SP), 37 (SP, US); Frutal, *Valls* 649 (US); Caldas, *Regnell III* 1369 (US); Pratinha, *Dorsett* 189b (US). RONDONIA: Vilhena, *Silva & Pinheiro* 4101 (MO, NY). SAO PAULO: Moji-Guaçu, *Mattos* 12255 (SP); Cajurú, *Sendulsky* 169 (SP); Botucatu, *Gottsberger* 950-95B (SP); Casa Branca, *Chase* 10951 (US); Cabaceiras, *Pickel* 5887 (US); de Santa Rita a São Simão, *Sendulsky* 148 (US); 4 km SW de Paraguaçu Paulista, *Clayton* 4596 (SP, US); campo de Itirapina, *Black* 51-11072 (BAA, US). MARANHÃO: Barra do Corda to Grajahú, *Swallen* 3648 (RB, SP, US).

When publishing this species, Chase described and illustrated the fragment of rachilla below the upper antheridium, showing the two constituent parts. Although she indicated that she had not observed this character in any other species of

the genus, she related *P. cervicatum* to *P. olyroides* Kunth, and in unpublished manuscripts placed both species in the "Olyroides" group; recently, Renvoize (1984) also related *P. cervicatum* and *P. ligulare* to *P. olyroides*.

However, in *P. olyroides* the characteristic stipe of sect. *Rudgeana* is absent, and there are long, acinate hairs at the base of the upper anthecium on its ventral face (Fig. 4d).

The spikelet is frequently obliquely disposed on its pedicel in *P. cervicatum*, a character present also in other species of *Panicum* (e.g., *P. hirtum*).

I consider one of the paratypes, *Williams 13221* of Venezuela, to belong to *P. vinaceum* Swallen. Consequently *P. cervicatum* remains known only from Brazil and northern Bolivia.

4. *Panicum ligulare* Nees ex Trinius, Gram. Pan. 206. 1826. TYPE: "V. sp. imperfectum Brasil (N. ab Esenb.)" (lectotype here designated: floriferous part, LE), non Nees, Agrost. Bras.: 196. 1829. TYPE: "Hab. in campis prope Almeirim provinciae Paraensis" (lectotype here designated: floriferous part of number 3800, M).

Perennial, 1.30–2 m tall, with thick adventitious roots and lanose cataphylls. Culms erect, many-noded; internodes 8–24 cm long, solid or hollow, pilose to glabrous; nodes dark, pilose to glabrous. Leaf sheaths 8–23 cm long, greenish to purplish, papillose-pilose, the hairs urticant and caducous; margins ciliate. Ligule 1.8–3.2 mm long, with long hairs on the back towards the base of the blade; collar pale, densely villous. Leaf blades linear-lanceolate, 30–55 cm long, 0.9–1.9 cm wide, flat, acuminate apically, subcordate basally, densely pilose on both surfaces to glabrescent, the margins ciliate and scabrous, involute or not, the midnerve prominent. Panicles lax, diffuse, many-flowered, 47–65 cm long, 15–30 cm wide, the branches spreading; axis longitudinally ridged, pilose towards its base, otherwise scabrous, the branches alternate or opposite, sometimes verticillate at the base of the panicle, scabrous, the axils of the branches pilose, pale to brown; axillary panicles usually absent, when present similar to the upper one but smaller; pedicels claviform, 2–20 mm long, scabrous. Spikelets ellipsoid, 4.4–5.7 mm long, 1.2–1.6 mm wide, glabrous, greenish to purplish. Lower glume 2.9–3.8 mm long, $\frac{1}{2}$ – $\frac{3}{4}$ the length of the spikelet, subulate apically, shortly pilose

towards the apex on the inner surface, 7–9-nerved, the midnerve scabrous. Lower lemma glumiform, 4.1–4.9 mm long, acuminate apically, pilose towards the apex in the inner surface, 5–7-nerved. Lower palea elliptic, 3–3.3 mm long, 0.9–1.5 mm wide, glabrous, whitish, membranous, the margins with or without short hairs; male flower absent. Upper anthecium ovoid, 2.5–3.2 mm long, 1.1–1.5 mm wide, pale; palea with compound papillae at the apex; stipe conspicuous, glabrous, with 1 or 2 wings nearly 0.8–1.1 mm long, the indurate portion 0.4–0.7 mm long. Caryopsis 2.4 mm long, 1.3 mm wide. In flower March–October. Figure 5.

Distribution. Brazil, from Maranhão and Bahia to Mato Grosso; cerrado; 500–1,100 m.

Common name. Capim elefante.

Additional specimens examined. BRAZIL. BAHIA: 150 km SW of Barreiras, *Irwin 14904* (F, MO, US). DISTRITO FEDERAL: Chapada de Contagem, ca. 20 km NE of Brasília, *Irwin & Soderstrom 5166* (US), *Irwin et al. 9653* (F, MO, NY, US). GOIAS: 20 km N of Cristalina, Serra dos Cristais, *Irwin et al. 13699* (F, GH, MO, NY, US), *13700* (F, MO, NY, US); 35 km NE of Catalao, *Irwin et al. 21525* (F, US); Serra Dourada, *Glaziou 22525* (US); vicinity of Goiás, *Chase 11460* (F, GH, NY); 26–31 km S of Goiania, *Davidse et al. 12278* (MO). MARANHÃO: Carolina to San Antonio de Balsas, *Swallen 4094* (US); Serra do Penitente, *Miranda 128* (RB). MATO GROSSO: between Rondonópolis and São Lourenço, *Chase 11987* (US); Rio Turvo, 210 km N of Xavantina, *Irwin et al. 16122* (F, MO, NY, US); Serra Azul, 77 km from Barra do Garças, *Hunt 6075* (NY, US); Serra do Roncador, 86 km N of Xavantina, *Irwin et al. 16386* (F, NY, US); Xavantina-Cachimbo road, 215 km from Xavantina, *Hunt & Ferreira Ramos 5606* (NY, US); 8 km NE of Base Camp, 12°54'S, 51°52'W, *Ratter et al. 2090* (NY, RB); Campos Novos, *Kuhlmann 1745* (RB).

Trinius (1826), in attributing *P. ligulare* to Nees, described the species as possessing a lanceolate, membranous ligule 6–10 mm long, and used the epithet *ligulare* in reference to this character. After examining abundant material of *P. ligulare* and studying the type of *P. ligulare* in Leningrad, I discovered that the type sheet contains a mixture of material. The panicle of this specimen does correspond to what I consider *P. ligulare* (which agrees with the description given by Trinius for the floriferous part), but the vegetative portion (which is separated from the floriferous part) is markedly different from the vegetative parts of the species. The leaf sheaths and leaf blades are completely glabrous, and the membranous ligule is exceptional because of its

size. This type of ligule has never been found in any species of *Panicum* up to now.

In 1829, Nees described *P. ligulare* as Trinius did, mentioning that the type of ligule he observed was unique in *Panicum*. In his description, Nees reported the type locality as "Hab. in campis prope Almeirim provinciae Paraensis." On studying the type material in Munich, I found two specimens collected by Martius in that locality, one with the number 3798 (attached to the plant) and the other identified as 3800. In 3800 there is a mixture of material similar to the specimen from Leningrad. Specimen 3800 is undoubtedly the one Nees used in his diagnosis. In specimen 3798 there is no mixture, and it fits perfectly with what I have described as *Panicum ligulare*. In this specimen there is a note on which Trinius stated that this material is different in its vegetative parts to the one examined at Leningrad.

Trinius (1835) and Steudel (1855) treated the species in the same way as Nees and Trinius did before.

Doell (1877), in *Flora Brasiliensis*, noted the difference between specimens 3798 and 3800 of Munich. He considered 3800 to be *P. ligulare* "in sensu strictiore," but erroneously judged 3798 to be *P. virgatum* (a completely different North American species).

I select the floriferous portion of the Leningrad material as the lectotype of *Panicum ligulare* Nees ex Trin., and the floriferous portion of the Munich specimen 3800 as a lectotype of *P. ligulare* Nees.

5. ***Panicum rudgei*** Roemer & Schultes, Syst. Veg. 2: 444. 1817. Based on *P. scoparium* Rudge, Pl. Guian. 1: 21, pl. 29. 1805, non Lam., 1798. TYPE: "*Panicum scoparium* Rudge, ex herb. Rudge" (fragment, US-2830540).

P. pilosissimum Roth ex Roemer & Schultes, Syst. Veg. 2: 458. 1817. TYPE: "Roth nov. plant Spec. Ms. . . . In Essequibo, Mertens" (fragment, US-2830939).

P. rudgei var. *brasiliense* Raddi, Agrost. Bras. 48. 1823. TYPE: ". . . in viciniis fluminis inhumirum, in locis silvosis et herbosis" (fragment, US-80665).

P. dasytrichum Sprengel, Syst. Veg. 1: 317. 1825. TYPE: "*Panicum dasytrichum* Spr. hirsutum Willd. herb. Hoffmansegg" (fragment, US-80665).

P. rhigiophyllum Steudel, Syn. Pl. Glum. 1: 76. 1855. TYPE: "*P. rigens* Salzm. Hrbr. Bahia" (isotype, US-81104).

P. cayennense var. *divaricatum* Doell, in C. Martius, Fl. Bras. 2(2): 220. 1877. TYPE: same as the species.

Perennial, 30–130 cm tall, with short rhizomes and pilose, scaly cataphylls. *Culms* decumbent or geniculate to erect, often zigzag, rigid, hollow, branching from the lower and upper nodes, many-noded; internodes 5–15 cm long, cylindrical, densely to sparsely pilose; nodes covered with whitish, appressed hairs to completely glabrous. *Leaf sheaths* 4–13 cm long, densely papillose with thick, glassy hairs; margins ciliate. *Ligule* 1.5–2 mm long, with long hairs on the back towards the base of the blade; collar pale, densely to sparsely pilose. *Leaf blades* linear-lanceolate, 20–40 cm long, 0.6–1.1 cm wide, acuminate apically, narrowed basally, flat or with involute borders, densely hispid to sericeous on both surfaces to glabrescent, the margins scabrous, ciliate or not in the lower portion, the midnerve manifest. *Panicles* terminal and axillary from the upper nodes, forming an elongated, compound inflorescence $\frac{1}{3}$ or more the length of the plant, 25–50 cm long, 10–20 cm wide; *axis* and branches longitudinally ridged, scabrous to pilose, the axils of the branches long-pilose to glabrous, brownish to pale, the branches alternate and divaricate, somewhat flexuous; pedicels scabrous, long-pilose, flexuous. *Spikelets* ovoid, acuminate, 3–3.5 mm long, 1–1.2 mm wide, pale to nearly purplish, sparsely hirsute, with stiff hairs irregularly distributed. *Lower glume* 2–2.7 mm long, $\frac{2}{3}$ as long as the spikelet, acuminate apically, with stiff, whitish hairs on the upper part to completely pilose, the inner surface pilose, 3–5-nerved, the midnerve scabrous. *Upper glume* 2.7–3 mm long, acuminate apically, pilose on the inner surface, 7–9-nerved, the midnerve scabrous. *Lower lemma* 2.5–2.9 mm long, acute apically, long-pilose to glabrous, 7–9-nerved, the midnerve scabrous. *Lower palea* elliptic, 1.8–2.3 mm long, 0.5–1.1 mm wide, membranous, the margins shortly pilose; male flower present, the anthers purplish; rachilla with or without whitish hairs. *Upper antheridium* ellipsoid, 1.8–2.2 mm long, 0.8–1.1 mm wide; palea with compound papillae towards the apex; stipe with the membranous portion ca. 0.4 mm long, the indurate portion 0.5 mm long, prolonged beyond the back of the lemma as a mucro. *Caryopsis* pale, 1.5 mm long, 1 mm wide. In flower all year.

Distribution. Mesoamerica, West Indies (Jamaica, Trinidad) and South America from Colombia to Bolivia and Brazil; 0–1,000 m; in open savannas, campos or cerrados, usually in sandy soils.

Common names. makuna-ta (Colombia); carricillo (Venezuela).

Chromosome number. $n = 9$ (Davidse & Pohl, 1974, 1978); $2n = 18$ (Pohl & Davidse, 1971).

Selected specimens examined. MEXICO. TABASCO: Achotal, *Matuda* 3087 (F, GH, US). GUATEMALA. IZABAL: Montaña del Mico, 6 mi. S of Izabal, *Steyermark* 38581 (F); Santa Cruz, N of Lago Izabal, *Steyermark* 39673 (F). BELIZE. Cabbage Hall, *Dwyer et al.* 454 (F, MO); Swasey Branch, Monkey River, *Gentle* 3862 (F, GH, MO, NY, US); Machaca, *Gentle* 6893, 6923 (F, NY, US). COSTA RICA. ALAJUELA: Buenos Aires, *León* 1184 (US), *Tonduz* 3679, 4875 (US); Los Palmares, *Pittier* 10588 (US). PUNTARENAS: Buenos Aires, *Molina* 27395 (F, MO, US); east of CIA, road to Buenos Aires, *Pohl et al.* 13116 (F, MO). SAN JOSE: Vicinity of El General, *Skutch* 3065 (GH, MO, NY, US), *Pittier* 12064 (US). NICARAGUA. ZELAYA: Entre Siuna y Limbaikán, *Seymour* 4977 (F, NY). PANAMA. Jaboga, *Killip* 4163 (US); Canal Zone, near Fort Randolph, *Standley* 28598 (MO, US); Perlas Archipelago, San José Island, *Johnston* 324 (GH, US). JAMAICA: James Hill, Upper Clarendon, *Harriss* 12845 (NY, US); Halliss Savanna, Upper Clarendon, *Harriss* 12235 (MO, NY, US); Bunkers Hill Savanna, *Harriss* 11170 (NY, US); Mason River Savanna, 275 miles NW of Kellits, *Proctor* 26301 (NY, US). TRINIDAD. O'Mearey Savanna, *Soderstrom* 1010 (US), *Britton & Hazen* 1563 (NY, US); Pitch Lake, *Hitchcock* 10083 (MO, NY, US); St. Joseph, *Hitchcock* 10181 (US); Piarco Savanna, S of Dabadie, *Britton* 688 (NY). COLOMBIA. AMAZONAS: Corregimiento de Araraucara, *Aguirre Galviz* 877 (COL). ANTIOQUIA: Morro Pan de Azúcar, *Orozco et al.* 767 (COL). GUAINIA: Río Guainía, Puerto Colombia, *Schultes et al.* 17936 (US). META: 73 km W of Las Gaviotas, *Davidse* 5390 (MO); 43 km NE of Puerto López, *Davidse* 5106 (MO); 15 km al E de San Martín, *Blydenstein* 1658 (MO). NORTE DE SANTANDER: La Motilona, hoyo del Río de Oro, *García Barriga* 18723 (NY, US). SANTANDER: Entre Puerto Wilches y Puerto Santos, km 16, *Killip & Smith* 14859 (F, GH, MO, NY, US). TOLIMA: El Convento, W of San Lorenzo, *Pennell* 3509 (F, GH, MO, NY, US). VAUPES: Cerro de Circasia, *Cuatrecasas* 7201 (US). VICHADA: 25 km E of Cumaribo, *Davidse* 5325 (MO); 10 km W of Las Gaviotas, *Davidse* 5367 (COL, MO, NY). VENEZUELA. AMAZONAS: Cerro Duida, *Maguire* 29424, 29060 (NY); Serrania Parú, *Cowan* 31486 (NY, US); 20 km S of Puerto Ayacucho, *Davidse* 2841 (MO); 5 km NE of San Carlos de Río Negro, *Liesner* 3703 (MO); 25 km S of Samariapo, *Gentry & Berry* 14600 (MO); Yavita, *Williams* 13879 (F, US); pie del Cerro Huachacamari, *Huber* 4990 (MO); El Manguito, 1 km N of Caño Caname, *Davidse et al.* 17482 (MO); alrededores de Canaripo, *Huber* 1981 (MO); 8 km S de Puerto Ayacucho, *Davidse & Huber* 14916 (MO). ANZOATEGUI: Vicinity of Santo Tomé, *Chase* 12841 (GH, US). APURE: end of the Galerías de Cinaruco, *Davidse & González* 14667 (MO); near the Río Meta at Fundo El Algarrobo, *Davidse & González* 14217 (MO). BARINAS: 16 km SW of the Merida intersection just outside of Barinas, *Davidse* 3182 (MO, NY). BOLIVAR: Sabanas de Santa Teresa, *Tamayo* 2808 (MO); Gran Sabana, S of Mt. Roraima, *Steyermark* 59429 (F, US); 0.5 km NE of

Urimán, *Steyermark & Wurdack* 22 (F, NY, US). MONAGAS: E de Maturín, ca. caserío La Pica, *Aristeguieta* 4048 (F, MO, NY); Laguna Mosú, 12 km N de Capirito, *Trujillo* 14194 (F). ZULIA: 60 km NW of Santa Bárbara-San Carlos del Zulia, near Campamento El Rosario, *de Bruijn* 1473 (MO, NY, US). GUYANA. Tumatumari, *Gleason* 40 (GH); Waini River, *de la Cruz* 3634 (F, GH, MO, US); Waramuri Mission, Horuka River, *de la Cruz* 2576 (F, GH, MO, NY, US); Bartica, Hills Estate, *Hitchcock* 17191 (F, MO, NY, US); Kaie-teur Falls, Potaro River, *de la Cruz* 4478 (F, GH, MO, NY, US). SURINAME. Zandery, *Samuels* 233 (GH, NY, US); Kwatta, *Maguire* 23912 (F, GH, MO, NY, US); Sanderijl, *Archer* 2745 (US). FRENCH GUIANA. Vicinity of Cayenne, *Broadway* 348 (GH, NY, US); 10 km from St. Laurent, on road to Cayenne, *Cowan* 38943 (US). PERU. LORETO: Nauta, Río Maraón, *Gentry et al.* 29965 (MO); vía Nauta-Iquitos, *Díaz & Jaramillo* 1270 (MO). BOLIVIA. BENI: 15 km W de Guayamerín, camino a Riberalta, *Krapovickas & Schinini* 35068 (US). LA PAZ: San Carlos, *Buchtien* 32 (GH, MO, NY, US); Apolo, *Williams* 1020 (NY); San Antonio, *Buchtien* 1159 (US). BRAZIL. AMAPA: Araguari River, 20 minutes downriver from Porto Platón, *Pires et al.* 50973 (F, GH, NY, US); Porto Platón, *Silva* 2782 (NY, RB). AMAZONAS: Cucuí, Rio Negro, *Nascimento et al.* 194 (MO); km 20 on road from Humaitá to Labrea, *Prance et al.* 3386 (F, MO, NY, US); Fortaleza Savanna, Rio Puciari, *Prance* 13791 (F, GH, NY). BAHIA: Salvador, *Chase* 7883 (F, GH, MO, NY); 35 km E of Eunápolis, *Harley* 17285 (CEPEC, MO, NY); Maraú, *Belém & Pinheiro* 2121 (CEPEC), *Zuloaga et al.* 2464 (RB, SI, US); road BR-418, 16 km del cruce con BA-001, *Mori et al.* 9674 (CEPEC, NY). MATO GROSSO: Serra Azul, 75 km S of Xavantina, *Irwin et al.* 17302 (F, MO, NY, US); 270 km N of Xavantina, *Ratter* 2069 (NY); Serra do Roncador, 60 km N of Xavantina, *Irwin et al.* 15961 (F, MO, NY, US). MATO GROSSO DO SUL: Tres Lagoas, *Chase* 10745 (US). PARA: Santarém, *Swallen* 3721 (US); Soure, Ilha do Marajó, *Swallen* 4974 (US); Acará, Thomé Assú, *Mexia* 5921, 5975 (F, GH, MO, NY, US); 73 km NE of Castanhal, *Davidse et al.* 17939 (MO, NY); 17 km SE of Vigia, along road Pa-140, *Davidse et al.* 17610 (MO, NY). PERNAMBUCO: Vicinity of Recife, *Chase* 7675 (F, US); Poazeves, *Pickel* 3137 (US). RIO DE JANEIRO: Silvestre, *Holway et al.* 1116 (US); Merity, 20 km N of Rio de Janeiro, *Chase* 8465 (US). RONDONIA: Porto Velho, *Black & Cordeiro* 52-15348 (US). RORAIMA: Igarapé Agua Boa, Rio Mucajaí, *Prance et al.* 4035 (MO); Sierra de Sururucu, *Prance et al.* 9899 (F, MO); Boca da Mata, base de Serra Tepequem, *Prance et al.* 4274 (MO). SAO PAULO: São Simão, *Kuhlmann* 4110 (US); 7 km de São José dos Campos, *Eiten & Mimura* 3351 (MO, US).

6. *Panicum vinaceum* Swallen, Fieldiana. Bot. 28(1): 27. 1951. TYPE: Venezuela. Bolívar: Gran Sabana, between Kun and waterfall at Rue-Meru, south of Mount Roraima, elev. 1,065 m, 2 Oct. 1944, *J. A. Steyermark* 59173 (holotype, US-1911661; isotype, F).

Perennial, 40–100 cm tall. Culms erect, few-noded; internodes 6–11 cm long, pilose; nodes

pilose. *Leaf sheaths* 4–14 cm long, covered by long dense hairs or glabrescent; margins ciliate to glabrous. *Ligule* 0.6–2 mm long; collar pale, pilose. *Leaf blades* linear-lanceolate, 15–42 cm long, 0.5–1.2 cm wide, flat, acuminate apically, subcordate basally, with appressed hairs on both surfaces to glabrescent, the margins scabrous, ciliate or not. *Panicles* lax and diffuse, 12–50 cm long, 6–20 cm wide, the branches spreading; *axis* longitudinally ridged, scabrous, the branches alternate to opposite, scabrous, the axils of the branches pilose, pale; axillary panicles usually absent, when present similar to the terminal one but smaller; pedicels scabrous. *Spikelets* ellipsoid, 5.9–6.7 mm long, 1.5–2 mm wide, globose and glabrous, pale to purplish, the inner surface of the glumes and lower lemma densely to sparsely pilose. *Lower glume* 2.9–3.8 mm long, subulate apically, 5–9-nerved, the midnerve scabrous. *Upper glume* 5.3–6.4 mm long, acuminate apically, 7–11-nerved, glabrous. *Lower lemma* 5.1–5.5 mm long, acute apically, 7–9-nerved. *Lower palea* obovate, 3.1–4 mm long, 1–1.5 mm wide, whitish, membranous, the margins pilose; male flower absent. *Upper antheridium* ovoid, 3–3.5 mm long, 1.4–1.8 mm wide, pale; stipe with the membranous portion 0.7–1.2 mm long, with or without wings, the indurate portion ca. 0.9 mm long, obtuse; rachilla pilose below the upper antheridium. *Caryopsis* 2.4 mm long, 1.5 mm wide. In flower September–April.

Distribution. Brazil and Venezuela; 100–1,000 m; savannas.

Additional specimens examined. BRAZIL. GOIAS: Rio da Prata, 6 km S of Posse, *Irwin et al.* 14509 (US). PARA: Serra do Cachimbo, BR-163 Cuiabá-Santarém, km 823, *Prance et al.* 24993 (MO, NY); Serra do Cachimbo, *Pires et al.* 6302 (BAA, US). VENEZUELA. AMAZONAS: El Ratón, *Williams* 13221 (F, US); alrededores de Puerto Ayacucho, 15 km al norte, *Huber* 862, 1351, 2131 (MO). BOLIVAR: El Dorado, S of La Gran Sabana, *Davidse* 4929 (F, MO, NY, US); Estación Bolívar, en sabanas de Santa Elena, *Tamayo* 2964 (MO, NY, US).

This species is closely related to *P. cervicatum*, from which it can be separated only by the sizes of the spikelet, lower palea, and upper antheridium. The rest of the differential characters noted by Swallen (size and pilosity of the plants and size of the panicles) have no value in separating the two species. *Irwin 14509* is exceptionally large and differs from Swallen's description. Nevertheless, spikelet size (a constant character in the

scant material available for this species), shows that *Irwin 14509* must be included in *P. vineaceum*, thereby partially modifying Swallen's concept of this species.

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